

User Guide

The introduction of Lotus’s spreadsheet solver in 1-2-3/G motivated the other spreadsheet vendors to develop or acquire solvers of their own. In 1990 – well before the launch of Windows 3.0 – Frontline won a competition among third-party Solver developers to create a Solver on an OEM basis for Microsoft Excel 3.0.

Frontline Systems Company History
<www.solver.com/>

0.1. Conventions and Organization of Files

To gain the full benefit of this book, you must have access to the accompanying Excel workbooks. We make constant reference to a variety of objects in Excel, and you must actively work with Excel while reading this book. Because changing parameters and seeing the results are so crucial to our approach, we have adopted several conventions that will help you navigate through our materials.

In this book, a *figure* refers to a variety of graphics, including charts and pictures of portions of a sheet. We often display a chart or range of cells in a figure in the printed book, but we want you to look at the live version on your computer screen. Thus, in addition to a caption, many figures have a source line indicating their location in the Excel workbook. We follow Excel’s naming convention for workbooks and sheets: [workbookname]sheetname. For example, if the source says, “[SimEq.xls]Data,” then you know the figure can be found in the SimEq.xls workbook in the *Data* sheet. We will always italicize sheet names in the printed text to help you locate the proper sheet in a workbook. We might also refer to cell C7 in the *Female* sheet of the PairedXYBootstrap.xls workbook as [PairedXYBootstrap]Female!\$C\$7.

You may need to adjust your display or the objects in Excel. Use the Zoom button to magnify the display. You can also right-click objects such as buttons (Why Bias?) or scroll bars (◀ | | ▶) to select and move them. Once you open a workbook, you can save it to another location or name (by executing

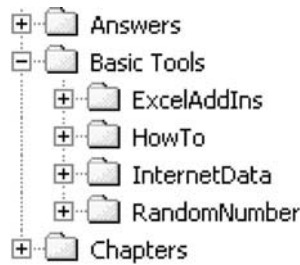


Figure 0.1.1. Organization of the CD-ROM.

File: Save As . . .) and make whatever changes you wish. This is the same as underlining or writing in a conventional printed book.

In addition to the Excel workbooks associated with the printed book, we also provide important additional materials with this book. Figure 0.1.1 shows the contents of all of the materials included in the CD-ROM. The Chapters folder contains the book itself with the accompanying workbooks always located in an ExcelFiles folder.

The Chapters and Answers folders are paired with each other. For example, in Chapter 5 on interpreting regression, there are several Excel workbooks. Some of the workbooks have questions, which are always located in the workbook’s Q&A sheet. The corresponding answers can be found in the Chapter 5 folder in the Answers folder. We think of the Q&A material in the Excel workbooks as self-study questions.

The book itself has other questions that we call Exercises. Readers do not have easy access to the answers to the exercise questions. To see these answers, you must register online as an instructor at <www.wabash.edu/econometrics>.

In addition to the Chapters and Answers folder, the Basic Tools folder contains software and additional material. The ExcelAddIns folder contains various supplementary programs that we have written for teaching and learning econometrics. Figure 0.1.2 lists the add-ins available with this book.

Each add-in folder has the add-in itself (with filename extension.xla) and a document with instructions on installing and using the software. As you work

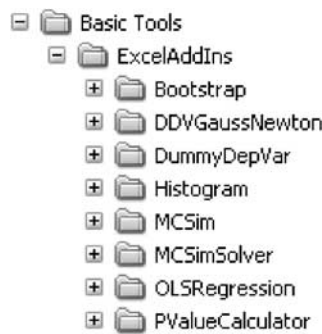


Figure 0.1.2. Available Excel add-ins.

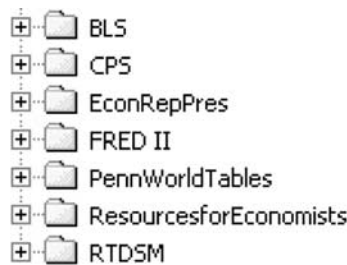


Figure 0.1.3. Internet data sources.

through the chapters in the book, you will have the opportunity to use these materials.

The *HowTo* folder in *Basic Tools* has a series of files that explain how to do a particular task in econometrics. For example, the *DeltaMethod.xls* workbook explains how to use the delta method to find the SE of an elasticity.

Figure 0.1.3 displays the contents of the *InternetData* folder. As you can see, we explain how to access, download, and import data from a variety of online sources. Each folder has detailed instructions and offers at least one example.

Finally, the *RandomNumber* folder (the last folder in *Basic Tools* in Figure 0.1.1) has extensive documentation on random number generation. Although this may seem an arcane, unimportant topic, we believe the increasing reliance on simulation means that every student of econometrics should understand the principles behind the creation of “random numbers” by a computer. Chapter 9 offers the basic explanation, and the *RandomNumber* folder provides more in-depth coverage.

Much of the value of this book lies in the Excel workbooks and additional materials. We hope you will read the book carefully and access the computer files as directed.

0.2. Preparing and Working with Microsoft Excel®

A working knowledge of Microsoft Excel is a prerequisite for this book. In other words, you must be able to open Excel files, write formulas that add cells together, create charts, and save files. As you will see, however, Excel is much more than a simple adding machine. It can be used to solve nonlinear optimization problems, run Monte Carlo simulations, and perform multiple regression analysis. In addition, we have packaged several add-ins with this book. They will provide additional features and functionality. Specific instructions for each add-in are provided as they are used.

In the next section, we provide a little background on Excel and explain how to configure your computer properly to enable you to work with the materials in this book.

A Brief History of Microsoft Excel

The first spreadsheet on a personal computer was called VisiCalc (short for “visible calculator”) and was created by Daniel Bricklin and Bob Frankston in 1978. Bricklin, a Harvard Business School student, was looking for an easier way to conduct a case study. He envisioned “an electronic blackboard and electronic chalk in a classroom.”¹ He recruited Frankston to help him write the code. VisiCalc was an instant success and was one of the first “killer apps.”

By the early 1980s, Lotus 1-2-3 was the leading spreadsheet. Lotus had bought and then discontinued VisiCalc. Borland’s Quattro Pro was another well-known product at that time.

In 1985, Microsoft Corporation came up with Excel for the Macintosh computer. This product was remarkable for its use of pull-down menus and a point-and-click device called a mouse. Other spreadsheets used a command line interface that required knowledge of cryptic DOS commands. “There is some controversy about whether a graphical version of Microsoft Excel was released in a DOS version. Microsoft documents show the launch of Excel 2.0 for MS-DOS version 3.0 on 10/31/87.”²

When Microsoft named its spreadsheet software “Excel,” it apparently did not know that Manufacturers Hanover Trust already had an automated banking program called Excel. As part of the settlement for trademark infringement, Microsoft agreed to refer always to its product as Microsoft Excel. In promotional materials, on its Web site, and even on the Windows Task Bar, Microsoft always calls its flagship spreadsheet program “Microsoft Excel.”

The rest of the 1980s were marked by intense competition. Lotus 1-2-3, Quattro Pro, and Microsoft Excel battled for dominance. Microsoft’s spreadsheet software pulled away from its competitors in the 1990s, and the product was marketed as part of a family of “office tools” that included Microsoft Word and PowerPoint.

Check Google results for entries related to “spreadsheet excel history” to learn much more about the fascinating history of how Excel came to be the dominant spreadsheet.

Excel Versions and Your Version

As Microsoft included new features and enhancements in Excel over the years, they released newer versions of the software. Excel 3.0, launched in 1990, featured the idea of many sheets in a workbook. Two years later, Microsoft gained market share with the release of Excel 4.0 along with

¹ <www.bricklin.com/history/sai.htm>.
² <dssresources.com/history/sshistory.html>.

Windows 3.1 – Microsoft’s first graphical user interface (GUI) operating system for the PC. In December 1993, Microsoft’s dominance was solidified with the release of Excel 5.0 because it was powered by Visual Basic instead of its own macro language (called Excel 4 Macro Language). Excel 7.0 for Windows95 debuted in July 1995. With Excel 8.0, in 1997, Microsoft changed the version pattern, for marketing purposes, to the year of release, calling the product Excel 97. Thus, Excel 2000 is Excel 9.0, Excel 2002 is 10.0, and in October 2003, Microsoft released Excel 2003 (Excel 11.0). As you would expect, Excel 2003 has new bells and whistles along with fixes and modifications of existing code, which includes a new set of algorithms for many statistical functions.

In addition to “major upgrades” that merit an entirely new version number, Microsoft occasionally releases slightly different versions to different market segments. For example, ExcelXP is actually a member of the Excel 10.0 family. You may also see references to Excel as Standard, Business, or Professional Editions.

Excel for the Apple Macintosh has a similar version history with new releases every few years, but you should be aware that Windows Excel and Mac Excel are not identical software and that there can be serious cross-platform compatibility problems. Our materials work with newer versions of Mac Excel, but buttons and dialog boxes may not display optimally. Mac Excel users should make sure to run Solver before using add-ins that require Solver.

Non-English-language versions of Excel should be fully functional with our materials (which have been tested with Spanish Excel). Excel (and other Office software) has several hundred different language versions, but it is only the front end that is in a different language. The Visual Basic engine that drives Excel is the same across all languages, and thus our workbooks and add-ins will work with foreign language versions of Excel. Of course, our text, buttons, and dialog boxes will be in English.

You can check the actual version of Excel on your machine by executing Help: About Microsoft Excel. Visit office.microsoft.com/officeupdate/ to obtain the latest security patches and updates for your version.

Excel 97 (or Mac Excel 2001) or greater is required to use the materials in this book. Your screen may sometimes look a little different than the screenshots in the book, but the basic functionality will be the same.

Properly Configuring Excel

To make sure that Excel is able to access and run the Visual Basic macros in the workbooks, security must be properly set.

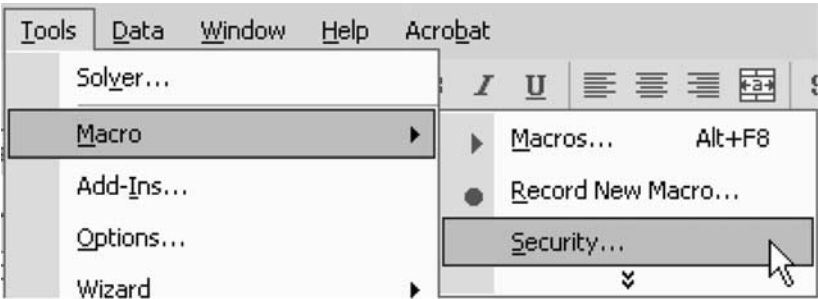


Figure 0.2.1. Accessing security options.

Step 1: From Excel, execute Tools: Macro: Security (see Figure 0.2.1).

At the Security Level tab, make sure that High is *not* selected (as shown in Figure 0.2.2). Medium will always give you a warning that the file you are about to open has macros, and then you can decide whether to run the macros (or open the file). Low is (quite reasonably) not recommended because Excel will automatically run all macros with no warning or prompt. Figure 0.2.2 shows the display from an older version of Excel. An additional option, Very High, is included in Excel 2003. Click the Trusted Sources tab and, as shown in Figure 0.2.3, make certain both boxes are checked to ensure that installed add-ins will have access to your Visual Basic Projects (i.e., your workbooks).



Figure 0.2.2. Setting security level.

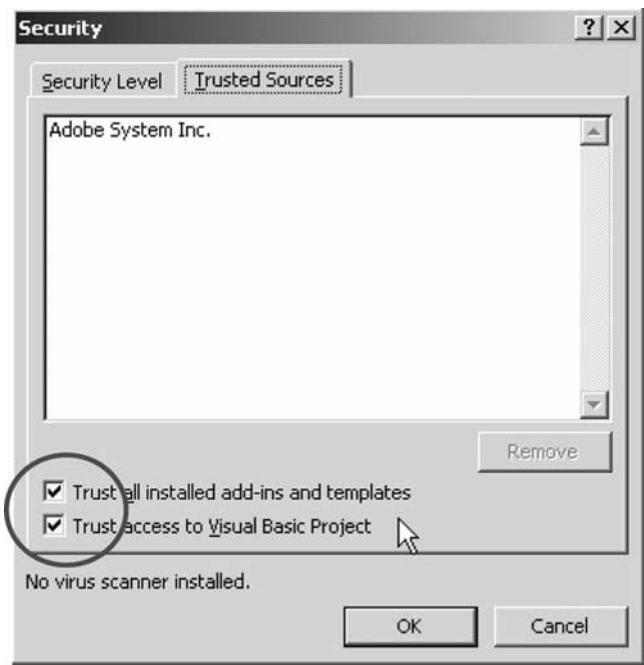


Figure 0.2.3. Setting trusted sources.

Security need be set only once because Excel will remember your settings. With Excel’s security correctly configured, you are ready to open the Excel workbooks on the CD and install add-ins as needed.

Step 2: From Excel, execute File: Open in order to open a workbook.
When opening a workbook from the CD, always click the “Enable Macros” option (see Figure 0.2.4). For workbooks not included with this book, do not click Enable Macros unless you are completely confident that the workbook is safe.

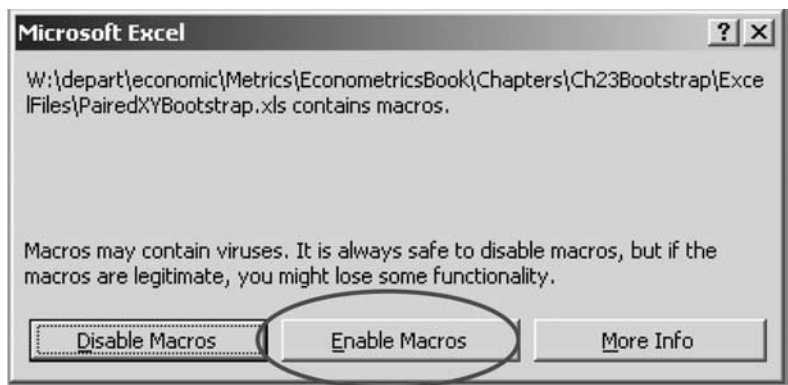


Figure 0.2.4. Opening a workbook with macros.

When you open a file from the CD, it will be read-only. Execute File: Save As and navigate to a folder on your hard drive or network space to save your work. You may drag the contents of this CD onto your hard drive and change the Attributes setting (by right-clicking on the file and choosing Properties) and checking off the Read-Only option.

Excel on a Macintosh

Macintosh users know that there can be problems working with Windows files, and Microsoft Excel does have some cross-platform compatibility issues. Fortunately, when opening our Windows-created workbooks, the content remains true. The display in Mac Excel, however, may not be optimal. Mac users may notice imperfections (such as cutting off text in buttons). We recommend adjusting the Zoom in Mac Excel to improve the display.

In addition, we have noticed that Solver in Mac Excel can be somewhat temperamental. Make sure you run Excel’s Solver before attempting to open a workbook that uses Solver. If you have trouble opening a workbook (e.g., you get an error message that says, “Can’t find project or library”), always try the following simple fix: quit Excel, open it, run Solver, and then open the workbook.

Troubleshooting

We guarantee that, at some point, something will go wrong while you are working with our materials. Your computer may freeze up or you will not be able to perform a particular task. The first step to overcoming difficulties is simply to start over. Often closing a workbook and reopening it is sufficient, but you may have to quit Excel or restart your computer.

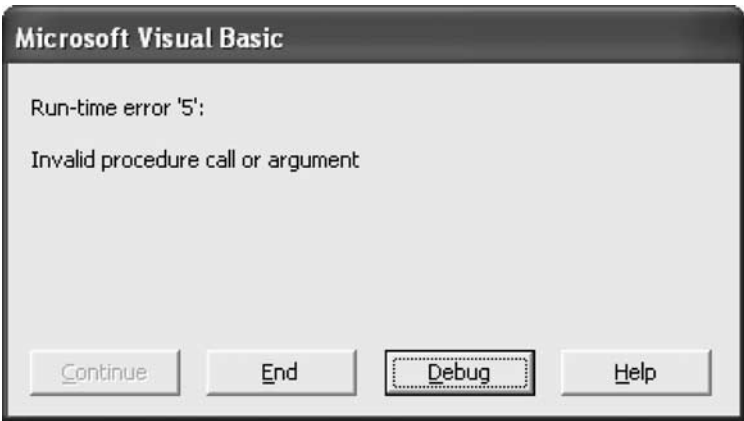


Figure 0.2.5. Error message example.

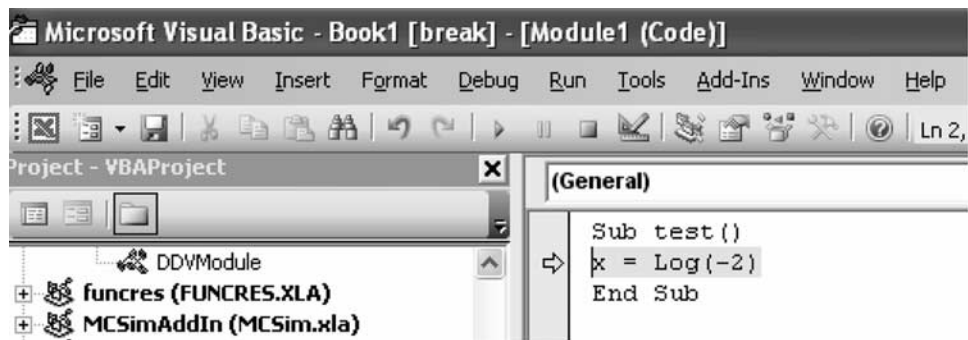


Figure 0.2.6. Debugging in Visual Basic.

We also suggest that you revisit the instructions and read carefully to make sure you are following each step closely. For example, in newer versions of Excel, you need to run Solver before accessing macros that use Solver. The instructions point this out, but it is easy to overlook this step.

An error message like that shown in Figure 0.2.5 may appear. If you click the End button, the message will disappear and you will return to where you were working in Excel. Clicking the Debug button takes you to Visual Basic and highlights the offending line of code, as displayed in Figure 0.2.6.

In some cases, you may be able to determine how to fix the error. In Figure 0.2.6, an attempt to take the log of a negative number has triggered an error in the subroutine named test.

We do not expect our readers to be proficient Visual Basic programmers, but with a little ingenuity you may be able to diagnose and correct the problem quickly. If not, we welcome your feedback, and we will try to fix problems associated with our workbooks.

We will keep an updated set of the latest versions of our workbooks and add-ins on the Web at <www.wabash.edu/econometrics>. If you have persistent problems with a workbook or add-in, please check the Web site to see if we have an updated, corrected version online.

1

Introduction

We find that a 10-percent permanent increase in the price of cigarettes reduces current consumption by 4 percent in the short run and by 7.5 percent in the long run.

*Gary Becker, Michael Grossman, and Kevin Murphy*¹

1.1. Definition of Econometrics

In this chapter we discuss the contents of this book, including the basic ideas we attempt to convey and the tools of analysis used. We begin with our definition of the subject: *Econometrics* is the application of statistical techniques and analyses to the study of problems and issues in economics.

The term econometrics was coined in 1926 by Ragnar A. K. Frisch, a Norwegian economist who shared the first Nobel Prize in Economics in 1969 with another econometrics pioneer, Jan Tinbergen.² Although many economists had used data and made calculations long before 1926, Frisch felt he needed a new word to describe how he interpreted and used data in economics.

Today, econometrics is a broad area of study within economics. The field changes constantly as new tools and techniques are added. Its center, however, contains a stable set of fundamental ideas and principles. This book is about the core of econometrics. We will explain the basic logic and method of econometrics, concentrating on getting the core ideas exactly right.

We divide the study of econometrics in this book into the following two fundamental parts:

- Part 1. Description
- Part 2. Inference

In each part, *regression analysis* will be the primary tool. By showing regression again and again in a variety of contexts, we reinforce the idea that it is

¹ Becker, Grossman, and Murphy, (1994, p. 396).
² A good source for more on the life and work of Frisch is Bjerkholt (1995). By the way, Frisch also came up with another common term – macroeconomics. “Polypoly,” however, never quite caught on. For more on the history of empirical analysis in economics, see <cepa.newschool.edu/het/schools/metric.htm>.